

Kindly delete the paragraph beginning on line 3 of page 1 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

The invention relates to a device for measuring AC currents in the form of a current sensor according to the preamble of claim 1.

Kindly delete the paragraph beginning on line 5 of page 1 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

Description of the Prior Art

Kindly delete the paragraph beginning on line 6 of page 1 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

Inductive measuring procedures according to the Rogowski principle are known in the area of current measuring technology. In the known models, the current-carrying conductor is routed through a coil. The sensor coil can vary in design. One design was described in DE 195 05 812 C2, in which an electrically insulating annular element is provided as the winding

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carrier. However, the disadvantage to this design is that production requires numerous different steps. Another disadvantage is that, when setting up a current sensor with an integrated electronic evaluation or calculation circuit, the coil in the form described in DE 195 05 812 C2 as a component in addition to the electronic components of the evaluation or calculation circuit have to be placed, secured and electrically connected. Therefore, the integration of this coil into an electronic evaluation or corrective calculation circuit is associated with a high space requirement and high costs for manufacturing the device as a whole. The additional requirement that sensors be miniaturized to make increasingly smaller models tailored to the respective application available cannot be met with a current acquisition coil according to DE 195 05 812 C2. In the description of another design according to US 5,414,400, the coil is fabricated directly on a printed circuit board using the printed conductors and through platings. Viewed in a radial direction, the printed circuit board segment between the through platings forms the electrically insulating annular element or annular segment. The printed conductors are oriented in such a way that the respective printed conductor on the top of the printed circuit board ends in a through plating for establishing an electrical connection with a printed conductor on the bottom, while the latter in turn ends in a through plating for establishing an electrical connection with an additional printed conductor on the top, thereby representing a winding around the insulating annular segment. The geometric orientation of the printed conductors yields a coil-like winding of the insulating annular segment, which, in its entirety, results in a current acquisition coil according to the Rogowski principle. The key disadvantage to the design described in US 5,414,400 is that the current-carrying conductor

must also be routed through the borehole enveloped by the coil. As a result, a current acquisition coil given this design cannot be placed around a current-carrying conductor for purposes of current acquisition at a later time. Another disadvantage is that the coil as designed has a go-and-return type of winding. It is proposed that the current acquisition coil be built around a two-layer printed circuit board, whose windings are quite symmetrically arranged over the entirety, but the individual windings alternate in dimensions. This disadvantage stems from the geometric requirement that the windings for practically two coils lying one inside the other be flatly accommodated on a printed circuit board.

Kindly delete the paragraph beginning on line 19 of page 2 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

The object of the invention is to realize an inexpensive, compact design for a device for measuring AC currents by means of a current acquisition coil based on a printed circuit board or a printed circuit board segment according to the Rogowski principle, which can at a later point be placed around and encompass the current-carrying conductor without interrupting the function of the current-carrying conductor. The structure of the windings must be very symmetrical in order to achieve a high measuring accuracy.

Kindly delete the paragraph beginning on line 6 of page 3 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

The device according to the invention for a current acquisition coil is realized with the help of a printed circuit board, which can be flipped open in such a way that the current-carrying conductor to be measured can be inserted in the provided area of the coil without interrupting or deactivating the current-carrying conductor. The opened device for a current acquisition coil is closed for measurement in such a way that the current-carrying conductor is completely enclosed by the current acquisition coil, and the current acquisition coil can measure the current of the current-carrying conductor according to the Rogowski principle. To satisfy additional requirements on the current acquisition coil relating to symmetrical structure or compactness, a multi-layer printed circuit board must be used. This offers more ways in which to control the printed conductor, and enables the most symmetrical structure possible for the current acquisition coil winding.

Kindly delete the paragraph beginning on line 17 of page 3 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

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The printed circuit board of the device for measuring AC currents is dimensioned in such a way that additional electronic components of an evaluation unit can be arranged thereupon. Relative to prior art, this makes it possible as a whole to dimension on a smaller scale and be more cost effective. The evaluation unit can perform a measured value conversion for conditioning measured value signals for open-loop and closed-loop controllers, running comparisons with limiting values and generating "too-low" or "too-high" messages, or for other applications.

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Kindly delete the paragraph beginning on line 12 of page 4 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

Brief Description of the Drawing ✓

Kindly delete the paragraph beginning on line 15 of page 4 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

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Fig. 2: The printed conductor progression for the coil segments involving the "go" path (20) and the "return" path (21) of the winding.

Kindly delete the paragraph beginning on line 1 of page 5 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

Fig.4: A variant of the device of the current acquisition coil as a single-piece printed circuit board with only one slot in the device, which can be placed around the conductor to be measured by opening the printed circuit board via twisting.

Kindly delete the paragraph beginning on line 7 of page 5 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

Detailed Description

Kindly delete the paragraph beginning on line 8 of page 5 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

Fig. 1 shows the arrangement according to the invention of a current sensor with a flip-open, annular printed circuit board as the current acquisition coil. The hinge 6 provides a flip-open link between the one printed circuit board half 1 and the second printed circuit board half

10. The current-carrying conductor 2 with its current to be measured is axially oriented and routed through the middle of the current acquisition coil. The printed conductors of the individual layers are not shown, but are alluded to with 4 and 5. The additional part of the printed circuit board 9 is preferably used to hold electric or electronic components for an evaluation circuit 19, which issues a scaled measuring signal to the output 13.

Kindly delete the paragraph beginning on line 9 of page 6 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

Fig. 3 shows the flip-open printed circuit board of the current acquisition coil in the flipped-open state for enveloping the current-carrying conductor 2. The printed conductor parts 1 and 10 are flipped open and spread apart until the current-carrying conductor 2 fits through the arising gap 11, and the current sensor can be passed over the current-carrying conductor in the direction of the arrow. The hinge 6 must permit the rotational movement of individual printed circuit board halves or only one printed circuit board half necessary to achieve a maximal gap width 11. Flexible conductors 12 are used to electrically connect one half of the current acquisition coil 1 in direct proximity to the hinge 6 with the other half of the current acquisition coil 10 with the help of electrical terminals 13 in the manner required for current acquisition according to the Rogowski principle.



Kindly delete the paragraph beginning on line 3 of page 7 pursuant to 37 CFR § 1.121(b)(1)(i) and replace the deleted paragraph with the following replacement paragraph pursuant to 37 CFR § 1.121(b)(1)(i) and in clean form pursuant to 37 CFR § 121(b)(1)(ii):

Fig. 5 shows a single-piece current acquisition coil on a multi-layer printed circuit board, in which the current-carrying conductor 52a, 54a is routed in an axial direction through the printed circuit board as a through plating 53. The terminals are routed via the current-carrying printed conductor 52 to the incoming current-carrying conductor 52a, and via the current-carrying printed conductor 54 to the continuing current-carrying conductor 54a. To ensure that the current to be acquired is relayed in an axial direction through the printed circuit board, the current-carrying printed conductors and printed circuit board terminals 56 are arranged on the outside of the printed circuit board 1. In this configuration, the current-carrying conductor is hooked up to the external current-carrying conductor parts 52a and 54a via electrical connectors 56. A printed circuit board segment 9 not used for the coil is preferably used to hold electric or electronic components for an evaluation circuit 19, which issues a scaled measuring signal to the output 13. The arrangement shown on Fig.5 is particularly advantageous for permanently fixed current sensors, which are no longer moved around after installation.

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